PROJECT FACT SHEET

CONTRACT TITLE: Integration of Advanced Geoscience and Engineering Techniques to Quantify Interwell Heterogeneity in Reservoir Models

ID NUMBER: DE-AC22-93BC14893

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CONTRACT PERFORMANCE PERIOD:
09/29/1993 to 11/30/1996

PROGRAM: Supporting Research
RESEARCH AREA: Rsvr Characterization

FUNDING ($1000'S)	DOE	CONTRACTOR	TOTAL
PRIOR FISCAL YRS	749	1,074	1,823
FISCAL YR 1997	0	0	0
FUTURE FUNDS	0	0	0
TOTAL EST'D FUNDS	749	1,074	1,823

OBJECTIVE: Integrate advanced geoscience and reservoir engineering concepts to quantify reservoir architecture and dynamics of fluid-rock and fluid-fluid interactions as they relate to lithologic characterization.

METRICS/PERFORMANCE:
Products developed: Area producers are using results of this study to implement or alter waterfloods in nearby fields. Additionally, comparison of Sulimar oil production to results of geologically similar reservoirs nearby will encourage area producers to consider improved reservoir management. These comparisons will be made available by the PRRC in hyertext form on the Gas and Oil Technology Exchange and Communication Highway (GO-TECH).

PROJECT DESCRIPTION:

Background: A more quantitative definition of reservoir heterogeneity is proposed through the integration of geologic, geophysical, and engineering databases into a multidisciplinary understanding of reservoir architecture and associated fluid-rock and fluid-fluid interactions.

Work to be performed: The interdisciplinary effort will integrate geological and geophysical data with engineering and petrophysical results through reservoir simulation to quantify reservoir architecture and the dynamics of fluid-rock and fluid-fluid interactions. Subcontractors from Stanford University and the University of Texas at Austin (UT) will collaborate on the project. The Department of Geophysics at Stanford, will couple crosswell reflection imaging and interwell transmission tomography in a procedure not attempted previously on field data. Further research, design, and interpretation of a single-well wettability tracer test developed in the UT laboratories but not yet field tested will be conducted. Several members of the PRRC staff will participate in the development of improved reservoir description by integration of the field and laboratory data as well as in the development of quantitative reservoir models to aid performance predictions.

PROJECT STATUS:

Current Work: The three-year project, initiated in September 1993, is in the third year.

Scheduled Milestones:

1. Project Planning (Completed)	04/94
2. Geology and Petrophysics Research	03/96
3. Hydrologic and Tracer Research	03/96
4. Geophysical Research	03/96
5. Field Tests	05/96
6. Reservoir Characterization/Simulation	09/96
7. Project Monitoring and Evaluation (Quarterly & Final Reports)	10/96
8. Technology Transfer	09/96

Accomplishments: Subcontractor agreements with the UT and Stanford were submitted, modified, and executed. Pecos Petroleum Engineering Inc. in Roswell, NM, was retained as the field site agent. A plan of operations for the Unit was submitted and reformatted into a PC-based relational database, well logs were incorporated with the basemap, and the status of all the wells in the Sulimar Queen Unit was updated. Geologic field work is completed. Numerous outcrop samples were collected for further study using the miniporopermeameter. Results from studies of outcrop and core samples will be correlated with various log parameters. All available data for the Sulimar Queen field has been entered into a workstation-based geological database. Data are now available for use in reservoir simulation studies.

Preserved reservoir core samples have been tested to determine wettability and flow parameters. Capillary pressures were measured by the centrifuge method with produced oil and synthetic reservoir brine; relative permeabilities were derived by matching centrifuge fluid production at single rotational speeds. USBM and Amott indices indicate weakly oil-wet conditions for the preserved core. All measurements were made at ambient temperature. Spontaneous imbibition tests with the same fluids show mixed-wet conditions with more water than oil imbibing.

Static reservoir pressures for all wells in the unit were determined, and these data serve as background information for the individual well and interwell tests that are scheduled. The PRRC pressure testing equipment and trailer were thoroughly evaluated, necessary replacement parts were ordered, and the equipment was refurbished and installed at the Sulimar Queen Unit for the pressure transient tests. An inverse drillstem test (DST) technique to estimate the flow capacity (permeability-thickness) was conducted in the field, and the results indicate that this method can be used satisfactorily to estimate in-situ permeability.

The crosswell seismic survey was completed in December 1994, and data processing is currently underway. The single well tracer test in Well 1-16 has been completed, and the single well wettability test is in the final design stage. In reservoir characterization, a direct method for estimating porosity from old gamma ray and neutron logs proved better than the neural network approach. However, new neural network techniques proved to be valuable in determining porosity in a nearby vuggy carbonate reservoir. Based on the estimated porosity logs, the core data, and the outcrop information, the reservoir was divided into two major flow and three geological units. The reservoir model was used to history match the primary performance period. The calibrated model was then used to predict the actual waterflood performance.